HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Carson National Fish Hatchery
Species or Hatchery Stock:	Spring Chinook Salmon
Agency/Operator:	United States Fish and Wildlife Service
Watershed and Region:	Wind River, Columbia River, Washington State
Date Submitted:	05/06/2004
Date Last Updated:	05/06/2004

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Carson National fish Hatchery

1.2) Species and population (or stock) under propagation, and ESA status.

Spring Chinook Salmon (*Oncorhynchus tshawytscha*)

1.3) Responsible organization and individuals

Indicate lead contact and on-site operations staff lead.

Name (and title): Rich Johnson, Fish and Wildlife Administrator
Agency or Tribe: U.S. Fish and Wildlife Service
Address: 911 NE 11th Ave., Portland, OR 97232
Telephone: 503-872-2766
Fax: 503-231-2062
Email: rich_r_johnson@r1.fws.gov

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Name (and title): William Thorson, Hatchery Manager
Agency or Tribe: U.S. Fish and Wildlife Service
Address: 14041 Wind River Highway, Carson, WA 98610
Telephone: 509-427-5905
Fax: 509-427-4238
Email: bill_thorson@r1.fws.gov

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Carson National Fish Hatchery Funding Source	
Project Name:	FY 2002 Mitchell Act Funding
Cooperator:	NMFS
Agreement Number:	AB133F-SE-0806
Office Fund Target:	$574,800.00
Cost Structure:	13215-1932-0003

Carson NFH Personnel	
Position	**Grade**
Supervisory Fishery Biologist (Manager)	GS-12
Supervisory Fishery Biologist (Assistant Manager)	GS-11
Fishery Program Assistant	GS-6
Maintenance Mechanic	WG-9
Motor Vehicle Operator (2 positions)	WG-6
Animal Caretaker	WG-4

1.5) Location(s) of hatchery and associated facilities.

Carson National Fish Hatchery (NFH) is located at river kilometer (rkm) 29 on the Wind River, Skamania County, Washington within the Columbia River basin. The actual position of the hatchery is 45°52'05" Latitude and 121°58'23" Longitude.

1.6) Type of program.

Isolated Harvest; Mitigation

1.7) Purpose (Goal) of program.

Carson NFH's spring Chinook salmon program was initiated in 1955. Carson NFH operates as part of the Columbia River Fisheries Development Program under U.S. v. Oregon and is funded through the Mitchell Act- a program to provide for the conservation of Columbia River fishery resources. The purpose of the hatchery is to successfully rear and release 1,420,000 spring Chinook salmon smolts for release on-station. Those releases are to help mitigate for fish losses in the Columbia River Basin caused by main stem hydropower project construction and operation and other basin development. Fish releases contribute to important terminal area tribal ceremonial and subsistence fisheries and non-tribal sport fisheries while providing for adequate escapement for hatchery production. Hatchery operations strive to meet mitigation requirements of the Mitchell Act and the Columbia River Fish Management Plan (U.S. v. Oregon).

1.8) Justification for the program.

Carson NFH was authorized by Special Act 50 Stat. 220, May 28, 1937, and placed into operation December 1937 to mitigate for the effects of federal water projects, primarily, Bonneville Dam. The hatchery was reauthorized by the Mitchell Act (16 USC 755-757; 52 Stat. 345) May 11, 1938 and amended on August 8, 1946 (60 Stat. 932) for conservation of fishery resources in the Columbia River Basin.

1.9) List of program "Performance Standards".

See table in section 1.10.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Program contributes to mitigation for construction of dams as defined in the Mitchell Act of 1937.	Spawn 1,000 spring Chinook salmon to produce 1.42 million smolts for release. Produce a run returning to the hatchery and for harvest.	Monitor adult return and contribution to fisheries and perform best rearing strategies to meet spawning and production goals.
Successfully maintain a broodstock of spring Chinook salmon at Carson NFH without the need for out of basin egg or fish transfers to the hatchery.	Achieve a minimum 0.1% smolt-to-adult return back to the hatchery.	Smolt-to-adult survival rates are monitored for each brood-year release.
Assure that hatchery operations support Columbia River Fish Management Plan (U.S. v Oregon) production and harvest objectives.	Collect between 1,000 to 1,400 broodstock to produce 1.42 million smolts for on-station release into the Wind River. Contribute to a meaningful harvest for sport, tribal, and commercial fisheries from March through July of each year in the Columbia and Wind rivers. Achieve a 10-year average of 0.5% smolt-to-adult survival that includes harvest plus escapement.	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock need. Work with states and tribes to establish meaningful fisheries (through US v Oregon forums).
Develop outreach to enhance public understanding, participation, and support of the U.S. Fish and Wildlife Service and Carson NFH programs.	Increase the visibility of the U. S. Fish and Wildlife Service facilities in the Columbia River Gorge and to provide information about Service programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts include festivals, classroom participation, stream adoptions, and county fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.
Implement measures for broodstock management to maintain integrity and genetic diversity of Carson hatchery stock.	A minimum of 1,000 adults are collected throughout the spawning run in proportion to age and sex composition at return.	Annual run timing, age and sex composition, and return data is collected and compared to historical data.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies, and executive orders on consultation and coordination with Native American tribal governments. Columbia River tribes support the service program at Carson NFH. An annual report on stock assessment and contribution to fisheries will be developed.	Hold an annual coordination meeting between the service and Yakama Nation to identify and report on issues of interest, coordinate management, and review programs.
Communicate and coordinate effectively with co-managers in the Columbia River basin.	Participate in US v Oregon production advisory committee (PAC) and technical advisory committee (TAC) meetings. Discuss management issues for Carson NFH at an annual coordination meeting each February between the Service, WDFW, NOAA Fisheries, and Yakama Nation.	Develop technical reports for PAC and TAC. Hold hatchery evaluation team meetings each spring and fall to review progress.
Design and implement projects to improve the quality of fish production at Carson NFH.	Projects are identified, reviewed, and implemented that will increase survival of program fish while minimizing impacts on wild populations.	Monitoring programs will be incorporated into project designs. Examples of projects include: diet studies, rearing and release studies, and rearing environment projects.

Release groups are sufficiently marked in a manner consistent with information needs and protocols to determine impacts to natural and hatchery origin fish in fisheries.	All fish are adipose fin clipped and 75,000 are implanted with coded wire tags to monitor and evaluate fish cultural techniques, survival, and fishery contribution.	All returning fish are checked for coded-wire tags by passing them through a tag detection unit.

	Risks	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Minimize impacts to ESA listed and other native species, their habitat, and the environment.	Adult ESA listed steelhead are allowed to pass the hatchery volitionally. Hatchery juveniles are raised to smolt-size (18 fish/lb) and released from the hatchery to expedite migration through the Wind and Columbia rivers. Mass mark all production fish to distinguish them from naturally produced fish.	The hatchery ladder is monitored to document if steelhead are entering. Juvenile passage is monitored in the Wind River by WDFW to determine the length of time fish spend in the river after release. Hatchery juveniles are also PIT-tagged and passage is monitored at Bonneville Dam. USGS Columbia River Research Laboratory conducts instream evaluations. Additional Service projects pending (straying, risk assessment, instream evaluations, fish health).
Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and the Service.	Prevent the introduction, amplification, or spread of certain fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of Carson NFH.	A pathologist from the Lower Columbia River Fish Health Center will examine the fish at least once per month to ascertain general health. Tests include the following examinations: regular, diagnostic, ponding, pre-release, and adult certification.
Effluent from artificial production facility will not detrimentally affect natural populations	Raceway cleaning effluent is sent to a pollution abatement pond where solids are removed prior to discharge.	Cleaning and total discharge (normal operation) effluents are monitored weekly for suspended and settleable solids.
Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	Adult steelhead volitionally pass the hatchery ladder to the upper Wind River. The primary water source, Tyee Creek, is not accessible to anadromous fish and the Wind River is used only as a secondary source. Hatchery intake meets screening criteria.	Number of steelhead entering the hatchery and water use is regularly monitored.
Hatchery operations comply with ESA responsibilities.	Hatchery conducts section 7 consultations and completes an HGMP. Section 10 permits are issued when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations.	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Harvest is monitored by state and tribal agencies to meet biological opinion on fisheries.

1.11) Expected size of program.

In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates effected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

Carson NFH sets a goal of 1,000 adults to be spawned so 1,400 adults are retained.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	**Release Location**	**Annual Release Level**
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Yearling	Wind River, 3rd week of April	1.42 million

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Table 1.12a. Egg-to-juvenile survival and recruit-per-spawner data from 1990 for Carson National Fish Hatchery, 1982-2001 (CRiS database, Carson CHMP).

Brood Year	Egg to Juvenile Survival (Percent)	Juvenile to Adult Survival (Percent)	Recruit per Spawner
1982		0.34	5.86
1983		0.41	3.98
1984		0.03	0.40
1985		0.21	1.28
1986			
1987			
1988		0.40	4.33
1989		0.13	1.46
1990	75.50	0.03	0.44
1991	80.35	0.02	0.18
1992	79.02	0.59	4.95
1993	58.73	0.22	1.76
1994	91.50	0.06	1.30
1995	95.53	0.37	6.21
1996	98.67		
1997	97.56		
1998	99.15		
1999	85.84		
2000	90.77		
2001	89.10		
Mean	86.81	0.23	2.68

Figure 1.12a. Smolt to adult survival of Carson National Fish Hatchery spring Chinook salmon, brood years 1980-1996 (2002 Carson CHMP).

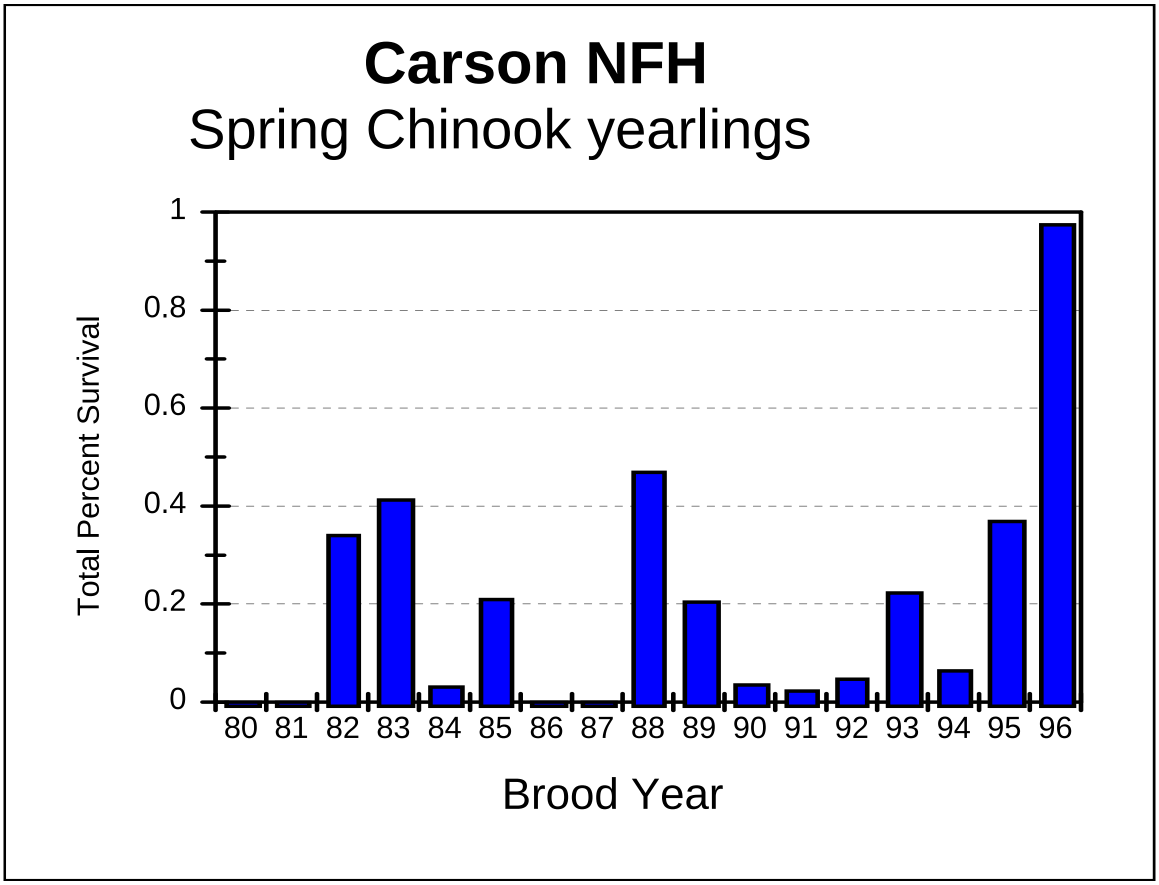


Table 1.12b. Number of Carson National Fish Hatchery spring Chinook salmon by age class counted at the hatchery, 1980-2001 (2002 Carson CHMP).

	Hatchery Fish to Hatchery				
Year	**Age-3**	**Age-4**	**Age-5**	**Age-6**	**Total**
1980	32	606	2,730	0	3,368
1981	3	901	1,609	0	2,548
1982	22	1,085	549	0	1,656
1983	9	1,072	1,413	0	2,494
1984	79	1,274	789	11	2,153
1985	53	3,591	1,090	0	4,734
1986	48	3,557	2,051	0	5,656
1987	7	2,464	1,907	0	4,378
1988	72	252	1,786	0	2,110
1989	118	1,883	287	8	2,296
1990	26	9,324	1,306	0	10,656
1991	37	1,178	3,105	13	4,333
1992	7	3,094	1,080	7	4,188
1993	12	1,455	2,972	0	4,439
1994	7	542	371	2	922
1995	104	361	100	0	565
1996	14	4,230	73	0	4,317
1997	5	2,911	488	0	3,404
1998	14	406	518	0	938
1999	95	3,524	109	0	3,728
2000	316	9,875	667	0	10,858
2001	92	11,010	972	0	12,074
Mean	53	2,936	1,181	2	4,173

1.13) Date program started (years in operation), or is expected to start.

Carson NFH began operation in 1937 to mitigate for the effects of federal water projects.

1.14) Expected duration of program.

Carson NFH program is ongoing.

1.15) Watersheds targeted by program.

Target watersheds include the Wind River sub-basin within the Columbia River basin.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1) Brief Overview of Key Issues

Mitigation. Carson National Fish Hatchery is authorized by laws and agreements to mitigate for salmon and steelhead losses from Federal activities and Federal dams (Mitchell Act).

Marking. The states of Washington, Oregon and Idaho are implementing selective sport and commercial fisheries (non-tribal) on marked hatchery fish. This selective fisheries management strategy requires that all hatchery produced fish targeted for harvest be mass marked.

Tribal managers generally disagree with the management strategy for mass marking and selective fisheries.

Juvenile Salmon Distribution and Production Numbers. Juvenile salmon are to be released from the hatchery in the spring as yearling smolts to promote quick downstream migration from the hatchery, through the Wind and Columbia Rivers to the estuary and ocean. The following release strategy is agreed to by the WDFW, Service and NOAA Fisheries: Smolts are mass released directly into the Wind River at 18 fish/pound or larger to minimize interaction with other fish populations. Releasing fish at 18 fish/pound or larger helps ensure that the released fish are functional smolts which actively migrate through the Wind River corridor, reducing competition with listed steelhead. Rearing the smolts almost exclusively on Tyee Springs water minimizes straying of adults, further reducing competition with native steelhead.

The Yakama Nation (YN) has expressed interest in the practice of scatter planting juvenile fish throughout the watershed for supplementation.

Beginning with brood year 1997, rearing space has been managed so that density indices (the ratio of weight of fish to rearing unit volume and fish length) at no time exceed 0.25 (Banks 1994). In order to achieve the low indices, total production was reduced from over 2 million to 1.42 million smolts. The results have been very encouraging. For example, prophylactic erythromycin treatments to control BKD are no longer given to fingerlings, and losses to BKD have declined dramatically. Reduced production numbers have also led to minimal use of Wind River water which in the past had been a source of pathogen transmission during rearing.

In summer of 2001 and 2003, we anticipated having extremely low and insufficient water supply for raising 1.42 million juveniles to full-term smolts. An interim plan by Service, NOAA Fisheries, WDFW, and YN was to have an emergency release from 10 ponds to distribute 250,000 juveniles in the lower Wind River if the hatchery water supply dropped to critically low levels during summer. Although this plan was agreed to by the fisheries managers and passed ESA concerns, some conservation groups were highly concerned about this potential action and its impact to listed steelhead and other resident trout. Fortunately water supply was adequate and an emergency early release was not necessary.

NATURES Rearing. NATURES rearing is the practice of employing techniques such as the addition of substrate, coloration, and cover to rearing units in order to mimic natural environs. The earthen ponds provide a NATURES rearing opportunity at the hatchery. Terrestrial vegetation, 2 to 3 feet tall, grows in these ponds during the summer fallow period providing excellent cover when the ponds are re-filled. Shade cloth placed over the upper earthen pond in 2001 to provide protection from the sun also seemed to work very well. Fish in this pond utilized nearly the entire pond after the shade cloth was hung rather than crowding into small areas shaded by the central walkway as they did prior to placement of the shade cloth. The production ponds were upgraded in 2002. The ponds were coated with Lifelast[4] polyurethane and colored to approximate Wind River substrate. The middle bank of raceways are also enclosed which provide shade.

Other Acceptable Stocks. If brood stock numbers are insufficient to meet hatchery production objectives, the hatchery will rear fewer fish. Carson stock from Little White NFH or Leavenworth NFH Complex would be acceptable for use at this facility.

Surplus Adult Salmon Distribution. In most years more fish return to the hatchery than are needed for brood stock. Most of these surplus fish are still in very good condition and are distributed to the Yakama Nation for ceremonial and subsistence use. Fish beyond Yakama tribal needs can be distributed to other tribes, as requested. Fish beyond tribal needs are distributed to federal prison programs. Fish not suitable for food are typically buried. Adult spring Chinook held for brood stock must be treated (injected) with erythromycin to control bacterial kidney disease infection. Erythromycin has not been cleared for use on food fish by the Federal Drug Administration, therefore, carcasses previously injected with erythromycin cannot be used for human consumption. Prespawn mortalities are unfit for human consumption and, in accordance with the Pacific Northwest Fish Health Protection Committee=s draft Salmon and Steelhead Carcass Distribution Protocols, cannot be used for stream enrichment outplants and must be buried on site as well. Surplus fish or spawned carcasses may be available for stream enrichment. If surplus adults are used for nutrient outplanting, the fish should either be individually screened or decapitated/eviscerated to minimize concerns of disease transmission.

Fish Passage and Ladder Management. Since there is no barrier dam at the hatchery, fish are not prevented from passing upstream of the hatchery. Hatchery fish volitionally enter the hatchery, homing to Tyee Creek. Wild steelhead pass on their own volition upstream of the hatchery. Few steelhead home into Tyee Creek. For example, for the last four years, only three steelhead have been observed swimming into the hatchery ladder.

Stock Transfers to Other Watersheds. Carson origin spring Chinook eggs, fry, and fingerlings have been transferred to a wide range of localities including Alaska (over 2 million eggs in the early 1970's), Oregon (22.9 million eggs from 1957 to 1993), Idaho (15.9 million eggs from 1960 to 1980), and several hatcheries in Washington (29.7 million eggs from 1957 to1991). The strain has prospered at many locations, for example

Leavenworth and Little White Salmon NFHs, Washington and Umatilla River, Oregon. Future plans for using Carson stock in another watershed are the responsibility of the agency proposing the transfer. The Service has no plans for transferring fish from Carson to another watershed at this time.

Insufficient Operations and Maintenance Funding Through the Mitchell Act. Increased demands on hatchery programs, including those required by ESA Biological Opinions, have strained hatchery budgets. Without increases in Mitchell Act funding, reductions in production programs may need to be made. Reducing hatchery production may allow the hatchery, and the Service, to meet some ESA requirements, but may not uphold mitigation and tribal trust responsibility. The Service is working with NOAA-Fisheries and other co-managers to address current budget shortfalls.

1.16.2) Potential Alternatives to the Current Program

Dam Removal. Mainstem Columbia River and Snake River Dam removal to restore habitat has been considered but is not currently regarded as a realistic alternative. Refer to the Federal Columbia River Power System Biological Opinion on the subject.

Removal of Condit Dam on the Big White Salmon River is under negotiation. Use of Carson NFH production for supplementation efforts after dam removal is possible, but currently not planned.

Removal of Hemlock Dam in the Wind River watershed is under negotiation. This action will restore habitat in Trout Creek. No hatchery supplementation is planned.

Marking. The Service has not made any unilateral decisions on marking but has undertaken actions to comply with ESA Biological Opinions. The Service will continue to coordinate actions with the states and tribes through U.S. v Oregon and NOAA Fisheries to comply with ESA actions and coordinate with the Pacific States Marine Fisheries Commission mark committee. In addition, the federal agencies are beginning discussion of a comprehensive marking strategy for the Columbia River Basin as identified by Action 174-1in the Federal Columbia River Power System Biological Opinion. The federal agencies (NOAA Fisheries lead) are meeting with the states and tribes to begin this effort.

This comprehensive marking plan should:
a) improve our ability to assess and monitor the status of naturally-producing (especially ESA listed) populations
b) monitor and evaluate hatchery programs, including hatchery reforms and stray rates
c) maintain critical harvest management and stock assessment information
d) monitor mark-selective fishery regimes established by the states
e) improve regional and watershed based marking decisions
f) be consistent with recovery plan goals
g) be coordinated through U.S. v Oregon, Pacific States Marine Fisheries Commission and U.S. - Canada forums

Size at Release. There is no specific study supporting the size at release at this facility, other than operational experience. Staff at Carson NFH recently changed their release size target from 18/lb to 16/lb. Staff have noted that this size seems to work very well, can be reached without pushing the fish, and usually results in a healthy fish with a reasonable amount of body fat. Recent return rates of greater than 1% smolt-to-adult survival currently support 16/lb as the appropriate goal for Carson NFH. Any changes in sizes at release need to be monitored for effects on fish health, survival, and age/size at return.

Location of Release. The Yakama Nation would like to see juvenile fish from the hatchery scatter-planted throughout the watershed. Impacts on the listed steelhead population and on spring Chinook brood stock collection would need to be assessed before starting this alternative. The current strategy of releasing fish directly from the hatchery works well for returning adults back to the Wind River, contributing to sport & tribal fisheries, and returning adults back to the hatchery. To change the release location, the hatchery objectives would need to change as well. Spring Chinook salmon were not native to the Wind River watershed and natural production of spring Chinook salmon is currently not an objective. Future plans will be negotiated, natural production of spring Chinook salmon investigated, and ecological risks (and benefits) to native steelhead (ESA listed) and trout evaluated.

NATURES Rearing. NOAA Fisheries biologists have proposed a full scale production test of NATURES rearing techniques at Carson NFH but have not been received funding.

Water Use (Drought). An alternative to an emergency release of 250,000 juveniles in the lower Wind River during drought conditions, would be to reduce production at Carson NFH and bury eggs and/or fish. The alternative of burying eggs and/or fish during drought years has been the least acceptable alternative to the agencies, as long as other alternatives are available and pass ESA concerns.

Other Stocks. Carson stock spring Chinook salmon adults return with minimal straying to other watersheds. Introducing another stock of spring Chinook salmon into the Wind River is not proposed by any agency or group.

Surplus Salmon Distribution and Hatchery Ladder Management. In 2001 and 2002, Service, NOAA Fisheries, WDFW and YN agreed to shut the ladder to the hatchery one month earlier than normal, on August 1, allowing fish to spawn and die naturally for stream enrichment and allowing potential natural production of spring Chinook salmon in the Wind River. Approximately 300 to 500 salmon were estimated to have remained in the river to spawn near the hatchery because of this action. There is a concern that excess adults left in the river serve as a source of pathogens, creating the potential for disease transmission to native and hatchery fish as well as concern over in-stream competition of juvenile fish for food and space. Furthermore, spring Chinook salmon were not native to the Wind River watershed. From discussions with the co-managers, it has been determined that the risks from ladder closure outweigh the benefits. The ladder will be left open throughout the spring Chinook salmon return with no ladder closure currently planned. Future plans will be negotiated, natural production of spring Chinook salmon investigated, and ecological risks (and benefits) to native steelhead (ESA listed) and trout evaluated.

Stock Transfers to Other Watersheds. Future plans for using Carson stock in another watershed are the responsibility of the agency proposing the transfer. The Service has no plans for transferring fish from Carson to another watershed at this time.

Native Steelhead as Hatchery Brood Stock. Biologists with WDFW have made inquiries on rearing captive brood summer steelhead should the native population reach dangerously low levels. To address this issue a feasibility report was prepared for the Wind River Restoration Team (Smith 1995). No further actions have transpired nor planned.

1.16.3) Potential Reforms and Investments[1]

- Current Marking[2] $$
- Volitional Release Study[3] $$
- NATURES Study[3] $$$
- Ecological Interaction Study[3] $$$
- Sufficient Funding for Hatchery Operations[2] $$$$

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS. (Non-Salmonid Species are addressed in Section 15)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

1999 Biological Opinion on Hatcheries (NOAA, Fisheries)
SEE SECTION 15 FOR USFWS TRUST SPECIES

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

The natural spawning spring Chinook salmon in the Wind River are not a targeted population

[1] For reference:

$	<$50,000
$$	$50,000 to <$100,000
$$$	$100,000 to <$500,000
$$$$	$500,000 to <$1,000,000
$$$$$	$1,000,000 to <$5,000,000
$$$$$$	>$5,000,000

[2] Annual Operations

[3] Annual Funding X 5 Year Study Period

of the Carson program. This hatchery-induced population is considered a depressed, non-native, composite production (wild and hatchery fish) population by WDFW (WDF et al. 1990). The NMFS (Myers et al. 1998) considers this population as not an ESA issue, as these fish were not historically present in the watershed. The five-year geometric mean natural spawning population size is 162 fish. The short-term abundance trend (the most recent 7-10 years, based on total escapement) is positive, + 0.1 % per year. The long-term abundance trend (1970-1996) is negative, - 2.9 % per year (Myers et al. 1998). The run of spring Chinook into the Big White Salmon River is considered extinct, primarily attributable to dam construction and habitat degradation (Myers et al. 1998).

Wind River native steelhead populations are depressed and listed as threatened under the ESA. Wind River steelhead are part of the lower Columbia River steelhead ESU.

Both native and sea-run cutthroat are known to exist in Wind River, but little is known of abundance or range. Sea-run cutthroat are probably limited to the lower Wind River and Little Wind River (2.2 river kilometers from mouth of Wind River) in terms of spawning area (Personal communication with Rawding, WDFW, 1999). Since there is a breeding population of coastal cutthroat trout in the lower Wind River, program fish from Carson NFH could potentially encounter out-migrants of the sea-run form of the cutthroat in the Wind River and main stem or estuary of the Columbia River. Time of out-migration of the sea-run cutthroat in the Columbia River may begin as early as March and peaks in mid-May (Trotter 1997) similar in time to the release of hatchery smolts. The size of the sea-run cutthroat trout smolts, 100mm-260mm (S. Barndt, USFWS, pers. comm.), is very similar to the size of the yearling hatchery smolts released from Carson NFH. Instances of predation by juvenile hatchery Chinook are thought to be low.

No reproducing population of bull trout exists in the Wind River (WDFW, 1997).

2.2.1) <u>Description of ESA-listed salmonid population(s) affected by the program.</u>
Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

The only anadromous salmonids that historically ascend Shipherd Falls are winter and summer steelhead. It is probable that pacific lamprey ascend the falls, but there is no data to verify this claim. Both steelhead and pacific lamprey are important fisheries to the Yakama Nation.

Wind River native steelhead populations are depressed and Federally listed as Threatened under the Endangered Species Act (ESA). This stock is part of the lower Columbia River steelhead Ecologically Significant Unit (ESU). Although historical estimates are not well documented, run size has been estimated at 2,500 fish (WDFW 2000). The average number of summer steelhead spawners in the Wind River during 1991-96 was 222 fish, 14% of the escapement goal of 1,557 fish (NMFS 1999a).

- **Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.** *(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for* *integration).*

The Carson NFH program will not directly affect any ESA-listed fish population.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

Wind River summer steelhead trout are listed as threatened in the lower Columbia River ESU. There is currently no steelhead hatchery production in the Wind River.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

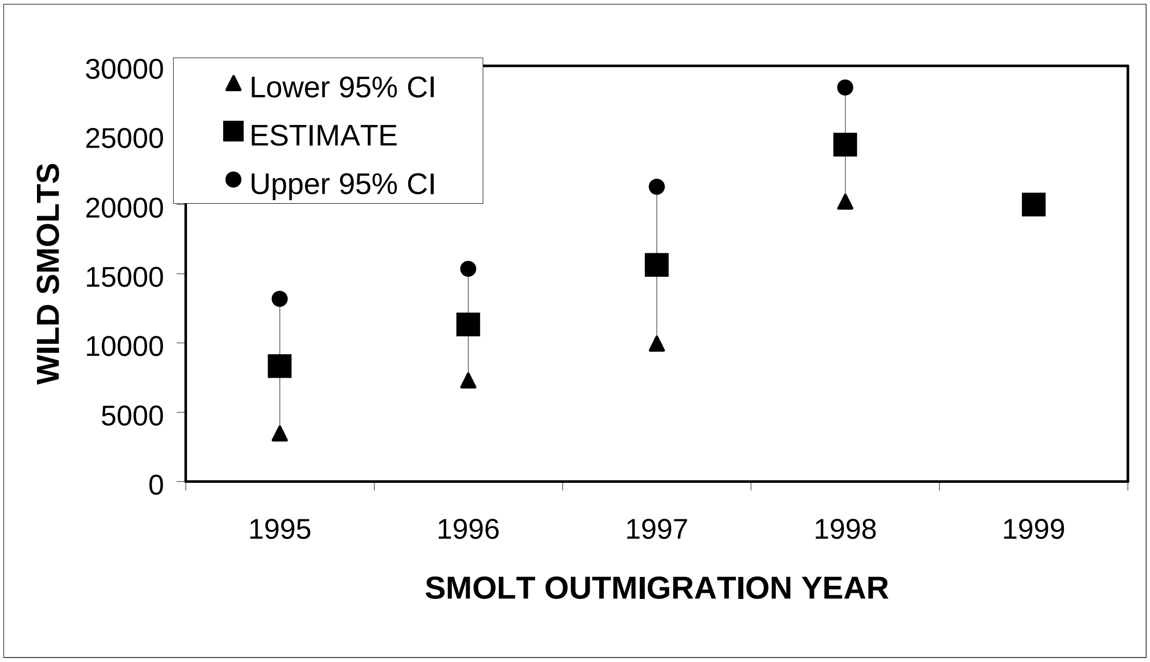
- **Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds** (*see definitions in "Attachment 1").*

The Lower Columbia River summer steelhead run is listed as threatened.

- **Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**

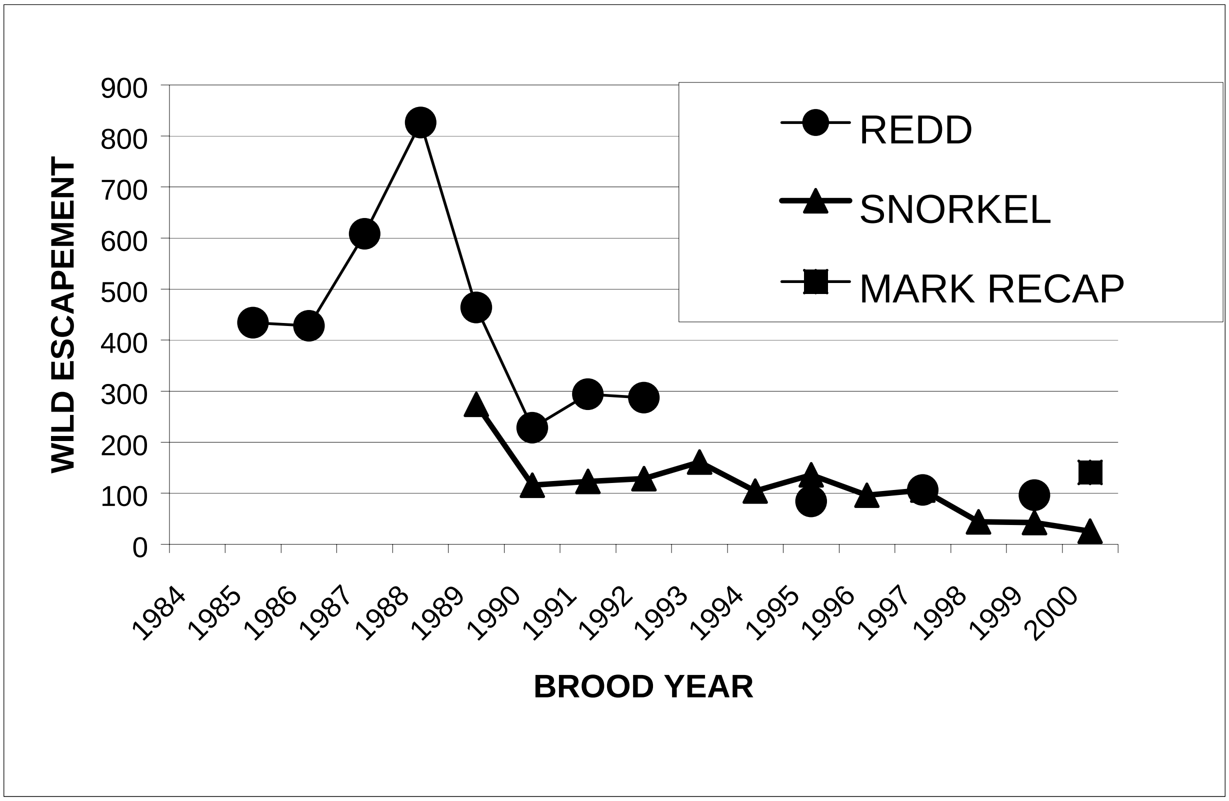
The following graphs are taken from the Wind River Subbasin Summary, 15 November 2000.

Figure 2.2.2a. Wild steelhead smolt yield in the Wind River, Columbia Gorge Province, from 1995-99 (1997 Wind River Subbasin Summary, WDFW).



- **Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**

Figure 2.2.2b. Wild summer steelhead abundance trends for the Wind River in the Columbia Gorge Province (1997 Wind River Subbasin Summary, WDFW).



- **Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

Not applicable to Carson NFH.

2.2.3) **<u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>** *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

Hatchery Water Intake and Use—The primary water source for the Carson NFH is Tyee Creek that is not accessible to anadromous fish. During limited periods of the year, water may be drawn from the Wind River to adjust water temperatures for rearing and to supplement Tyee Creek withdrawals. Intake screening for the Wind River withdrawal pipe does not meet current NOAA Fisheries ESA screening standards. However, with the reduced production program at Carson NFH, water withdrawal from the Wind River for hatchery operations are significantly reduced and short-lived when it does occur, which is primarily late in the summer. Work is underway to bring this water intake structure into NOAA Fisheries ESA compliance. Until the Wind River water intake structure is upgraded, withdrawal of Wind River water for hatchery operations will be minimized. A temporary screen is utilized when withdrawal from the Wind River is necessary. Water withdrawals for hatchery operations are not expected to have a significant negative impact on natural spawning populations. Entry of listed species into the hatchery through the river intake structure has not been observed.

In 1998, the Washington State Legislature passed Engrossed Substitute House Bill 2496 authorizing the establishment of Water Resource Inventory Areas (WRIAs) to catalogue anadromous fish limiting factors in Washington streams. The Wind River water diversion and blockage of Tyee Creek by hatchery facilities was considered a medium impact-limiting factor for salmon and steelhead in the Wind River. The Wind River diversion is listed because water withdrawal can exacerbate already low summer flows in the Wind River. However, the report recognizes that “recent modification to withdrawal methods may have improved conditions” in the Wind River. For example, push-up dams are no longer used for hatchery water withdrawal. Also, in 1995 the numbers of fish produced at the hatchery were reduced significantly, cutting back hatchery demand for Wind River water. Tyee Creek is listed because hatchery facilities are a total blockage to fish passage. There is some question concerning the suitability of Tyee Creek for salmon and steelhead spawning prior to hatchery construction. Much of Tyee Creek may have been a swampy area with little spawning gravel and much of the stream was channeled to facilitate water collection.

Hatchery effluents meet established water quality standards and are diluted by the flow in the Wind River.

Brood Stock Collection—Returning spring Chinook are collected for brood stock at the hatchery rack. Hatchery fish home to Tyee Creek and volitionally return to the hatchery using the hatchery’s fish ladder. There is no barrier dam in the Wind River at the hatchery. This is significant because the Wind River watershed upstream of the hatchery is an important spawning and rearing area for native summer steelhead trout (listed).

Natural spawning of spring Chinook occurs in the Wind River drainage (Pettit 1999a) but these fish are believed to be Carson NFH fish that do not return to the hatchery. Stray hatchery spring Chinook from other locations or returns from natural production from other areas are not known to occur at Carson NFH, however genetic testing would provide better information on the hatchery and natural spring Chinook populations in the basin.

Genetic Introgression—Coded-wire tag recoveries show that Carson NFH spring Chinook stray into the Little White Salmon NFH and are caught in the Drano Lake sport and tribal fisheries. However, the Carson spring Chinook stock is also released from Little White Salmon NFH. Straying of Carson spring Chinook is not considered a major problem in other streams where spring Chinook are listed based on a general lack of Carson CWT recoveries in other areas. Therefore, genetic introgression of spring Chinook released from Carson NFH with other listed spring Chinook stocks is not considered a significant problem. The Service is currently analyzing data to quantify the degree of straying of fish from our National Fish Hatcheries.

Hatchery Production—Carson NFH spring Chinook releases are moderate in magnitude relative to other Columbia River spring Chinook production programs. Carson NFH releases have been reduced from a previous program level of over 2 million smolts to the current 1.42 million level. Reduced production decreases density dependent effects and other potential ecological effects on other natural stocks. Juvenile out-migration trapping and PIT tag monitoring at Bonneville Dam indicate that Carson spring Chinook exit the Wind River quickly after release, further reducing potential density dependent effects. The Service will continue to evaluate our release strategies and production numbers to minimize any negative effect upon the aquatic community, especially on listed species.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _____*Summer Steelhead*_______ ESU/Population:____*Lower Columbia River*__________ Activity:_____*Carson NFH*_______________				
Location of hatchery activity:____*Wind River*______ Dates of activity:____________________ Hatchery program operator:_________________				
	Annual Take of Listed Fish By Life Stage (*Number of Fish*)			
Type of Take	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			<5	
Collect for transport b)			<5	
Capture, handle, and release c)			<5	
Capture, handle, tag/mark/tissue sample, and release d)			<5	
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			<5	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or

downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

If take levels are projected to exceed projections, consultation will be re-initiated with NOAA, Fisheries and co-managers.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.
(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").

--NMFS 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin

--Mitchell Act

--U.S. v. Oregon-Columbia River Fish Management Plan (currently under re-negotiation)

--IHOT Standards and Policies for Columbia Basin anadromous salmonid hatcheries

--NPPC Wind River Sub-basin Salmon and Steelhead Production Plan

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.
Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.

The spring Chinook program is consistent with:

NMFS 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin

Mitchell Act

U.S. v. Oregon-Columbia River Fish Management Plan (currently under re-negotiation)

IHOT Standards and Policies for Columbia Basin anadromous salmonid hatcheries

NPPC Wind River Sub-basin Salmon and Steelhead Production Plan

NPPC Production Review Document 99-15 and description of mitigation hatcheries

3.3) Relationship to harvest objectives.

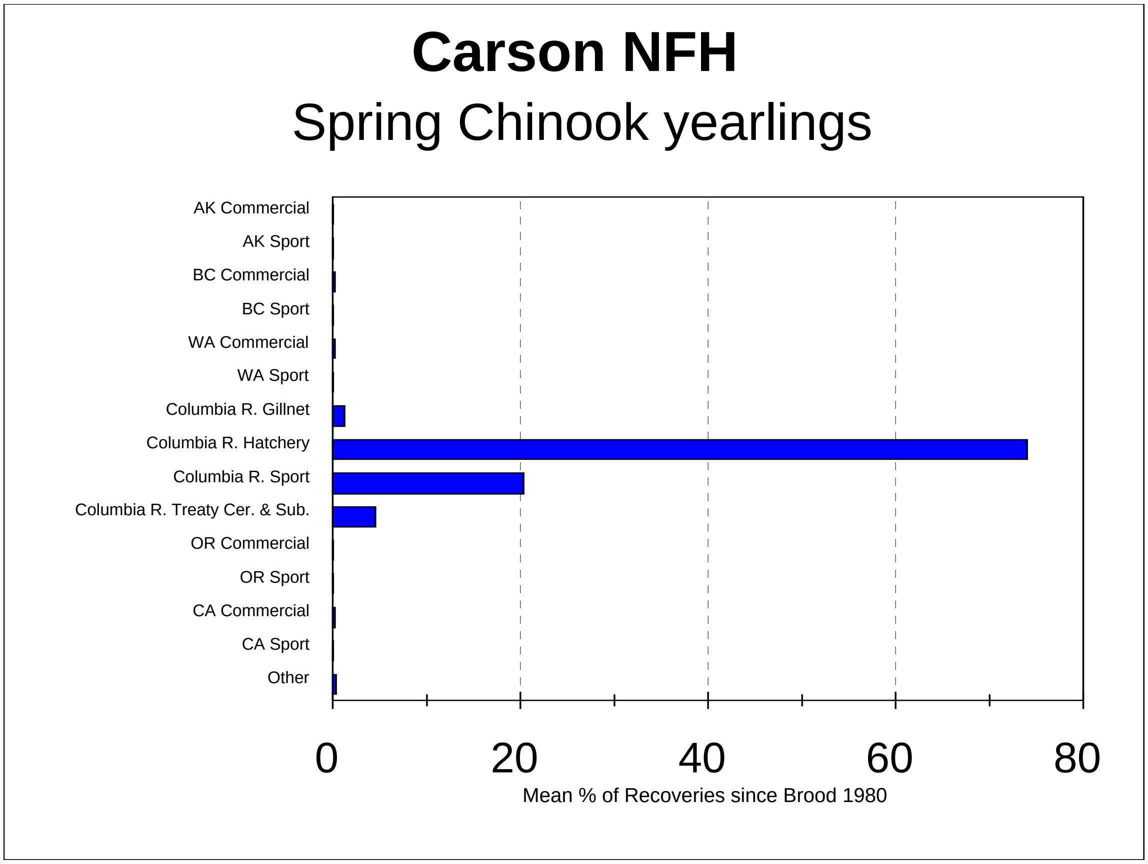
Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

Carson spring Chinook are not part of either the lower Columbia River Chinook ESU or the mid-Columbia River spring Chinook ESU, however, they do provide important fishery benefits to Columbia River fisheries. Upriver spring Chinook comprise a very minor component of the ocean fisheries with very few CWTs recovered in ocean fisheries. Columbia River main stem fisheries have been highly restricted in recent years (5 to 7 percent harvest rate) to address conservation needs and NMFS biological opinion jeopardy standards for listed Snake River spring/summer Chinook. Therefore, Carson spring Chinook contribute primarily to terminal area sport and tribal fisheries at the mouth of the Wind River. Providing terminal area fisheries is one of the management strategies to allow harvest opportunities while minimizing impacts on listed species and other stocks of concern. The average terminal area harvest rate for the period 1989-1998 was 0.439 for years when fisheries occurred (from Pettit 1999b). Average sport and tribal catches for this period for years when fisheries occurred were 2,615 and 868, respectively. Average tribal distribution of surplus fish from the hatchery for this period for years when tribal distribution occurred was 2,575 (from Pettit 1999b). Recoveries of CWTs from other stocks of concern (e.g., upper Columbia and Snake River spring Chinook) are extremely rare. The Wind River mouth fisheries provide quality terminal area fishery opportunity for sport and tribal fishers with minimal impacts to other stocks of concern. Also, all of the Carson NFH spring Chinook releases are mass marked for terminal area fisheries management. Main stem Columbia River fisheries are managed to achieve the NMFS biological opinion jeopardy standards for Snake River spring/summer Chinook of 5 to 7 percent harvest rate. So, production levels at Carson NFH are not expected to add adverse effects to listed species or other stocks of concern beyond those currently allowable under non-jeopardy biological opinions for harvest.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.

Data compiled from CRiS database.



3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions.

Natural production of spring Chinook salmon in the Wind River is not a management objective and Carson NFH is considered the primary source of natural spring Chinook production in this watershed.

Carson spring Chinook are produced to mitigate for Columbia River hydro-system development, operation, and other basin development. Habitat degradation within the Wind River basin is primarily from forest management practices. Habitat restoration will entail long-term actions. If mitigation goals for lost and degraded habitat are to be achieved continued hatchery production will be required in the interim.

3.5) Ecological interactions.

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

A variety of freshwater and marine predators such as northern pikeminnows, Caspian terns, and pinnipeds, can significantly reduce overall survival rates of program fish. Predation by northern pikeminnow poses a high risk of negative impacts on the productivity of hatchery Chinook (SWIG 1984). Based on PIT tags recovered at a large Caspian tern, nesting colony on Rice Island, a dredge material disposal island in the Columbia River estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids reaching the estuary were consumed in 1997. The Fish Passage Center (Berggren 1999) estimates, from approximately 57,000 PIT tag recoveries on Rice Island that about 0.2% of all PIT tagged fish released into the Columbia River through 1991 showed up on Rice Island. The percentage had increased by a factor of ten by the 1997 and 1998 juvenile salmonid out-migrations, with hatchery and wild steelhead having been the most effected by the increased predation. A NMFS Working Group (NMFS 1997) determined that California sea lion and Pacific harbor seal populations in the three west coast states have risen by 5-7% annually since the mid-1970s. Their predation may now constitute an additional factor on salmonid population declines and may affect recovery of depressed populations in some situations.

Co-occurring natural salmon and steelhead populations in local tributaries and the Columbia River main stem corridor could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run Chinook salmon ESU (threatened); Snake River spring/summer-run Chinook salmon ESU (threatened); Lower Columbia River Chinook salmon ESU (threatened); Upper Willamette River Chinook salmon ESU (threatened); Upper Columbia River spring-run Chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Upper Willamette River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). An additional concern is the Southwestern Washington/Columbia River coastal cutthroat trout. See the ecological interactions discussion below.

Returning Chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system.

A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Reductions and extinctions of wild populations of salmon could reduce overall ecosystem productivity. Hatchery production has the potential for playing an important role in population dynamics of predator-prey relationships and community ecology. The Service speculates that these relationships may be particularly important (as either ecological risks or benefits) in years of low productivity and shifting climactic cycles. In addition, wild co-occurring salmonid populations might be benefited as schools of hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations.

Summer steelhead in the Wind River are part of the Lower Columbia River LCR steelhead ESU listed by NMFS as threatened under the ESA. Although the intra-specific impacts of steelhead hatchery fish on natural populations of steelhead within the LCR steelhead ESU have the greatest potential for detrimental effects, (NMFS 1999a) other inter-species interactions are also of concern. The Carson NFH spring Chinook program may adversely affect listed summer steelhead in the Wind River basin, but impacts are thought to be substantially below the jeopardy threshold (NMFS 1999a). For a more detailed account on this subject, the reader is referred to the discussion in those documents.

The 1999 Biological Assessment for the Operation of Hatcheries Funded by the National Marine Fisheries Service under the Columbia River Fisheries Development Program (NMFS 1999a) and the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999b) present a discussion of the potential effects of hatchery programs on listed salmon and steelhead populations.

A discussion of ecological interactions relative to the Carson spring Chinook program follows:

Genetic introgression- Based on CWT recoveries, Carson NFH spring Chinook do stray into the Little White Salmon NFH and are caught in the Drano Lake sport and tribal fisheries. However, the Carson spring Chinook stock is also the stock of spring Chinook released from Little White Salmon NFH and the Big White Salmon Ponds. Based on a general lack of Carson CWT recoveries in other areas, straying of Carson spring Chinook is not considered a major problem for other streams where they are listed. Therefore, genetic introgression of spring Chinook released from Carson NFH with other listed spring Chinook stocks is not considered a significant problem.

Hatchery production (density dependent effects)- Carson NFH spring Chinook releases are moderate in magnitude relative to other Columbia River spring Chinook production programs. Carson NFH releases have been reduced from a previous program level of about 2.4 million smolts to the current 1.42 million level. This was done to lower densities during rearing with the goal of improving fish quality and survival. Added benefits would be reduced density dependent effects and other potential ecological effects on other natural stocks. Juvenile out-migration trapping and PIT tag monitoring at Bonneville Dam indicate that Carson spring Chinook exit the Wind River quickly after release, further reducing potential density dependent effects. The reduced level of production at Carson NFH is not expected to cause significant density dependent effects in the Wind or lower Columbia rivers.

Disease- Fish managers largely understand the strain, abundance, and virulence (epidemiology) of pathogens and parasites in hatchery fish. Recent studies suggest that the incidence of some pathogens in naturally spawning populations may be higher than in hatchery populations (Elliot and Pascho 1994). Indeed, the incidence of high ELISA titers for *Renibacterium salmoninarum*, the causative agent of Bacterial Kidney Disease (BKD), appears, in general, to be significantly more prevalent among wild smolts of spring/summer Chinook salmon than hatchery smolts (Congleton et al. 1995; Elliot et al. 1997). For example, 95% versus 68% of wild and hatchery smolts, respectively, at Lower Granite Dam in 1995 had detectable levels of *R. salmoninarum* (Congleton et al. 1995). Although pathogens may cause significant post-release mortality among hatchery fish, there is little evidence that hatchery origin fish routinely infect naturally produced salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986; Steward and Bjornn 1990). Many biologists believe disease-related losses often go undetected and that the impact of disease on naturally spawning populations may be underestimated (Goede 1986; Steward and Bjornn 1990). Nevertheless, we are unaware of any studies or documentation in the scientific literature where hatchery fish have infected a naturally spawning population of salmon or steelhead in the Pacific Northwest (see also Campton 1995).

Carson NFH follows Integrated Hatchery Operations Team (IHOT 1995) and Pacific Northwest Fish Health Protection Committee protocols for disease sampling and treatment. The Lower Columbia River Fish Health Center is located nearby at Spring Creek NFH so fish health sampling, diagnosis, and treatment are readily available as fish health issues arise. The fish health goal for Carson NFH is to release healthy fish that are physiologically ready to migrate. Carson spring Chinook are released directly into the Wind River at the hatchery site and only pass one main stem Columbia River dam (Bonneville Dam) en route to the ocean. Carson spring Chinook have a reduced potential for transmission of disease to other populations relative to other upriver programs that are subjected to the high density impacts and stresses of collection for transport and/or diversion through multiple bypass systems. Disease transmission may be triggered by increased population density and unusual changes in environment such as would occur at transport collection facilities and juvenile bypass systems.

Our general conclusion at this time is that Carson NFH, as are all federal hatcheries in the Columbia River Basin, takes extensive measures to control disease and the release of diseased fish. As a consequence, infection of natural fish by hatchery fish does not seem to be a problem. However, a concern to fish health personnel is the decision to close the hatchery ladder to adult spring Chinook on 1 August 2001 and 2002. These closures may keep more adults in the river and increase potential transmission of the infectious hematopoietic necrosis virus to steelhead. Closure of the hatchery ladder should be examined closely to determine if the fish health risks outweigh the potential natural production benefits.

Competition- Impacts from competition are assumed to be greatest in the spawning and nursery areas at points of highest density (release areas) and diminish as hatchery smolts disperse (USFWS 1994). Salmon and steelhead smolts actively feed during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). Competition in reservoirs could occur where food supplies are inadequate for migrating salmon and steelhead. However, the degree to which smolt performance and survival are affected by insufficient food supplies is unknown (Muir et al. 1994). On the other hand, the available data are more consistent with the alternative hypothesis that hatchery-produced smolts are at a competitive disadvantage relative to naturally produced fish in tributaries and free-flowing main stem sections (Steward and Bjornn 1990). Although limited information exists, available data reveal no significant relationship between level of crowding and condition of fish at main stem dams. Consequently, survival of natural smolts during passage through the dams does not appear to be affected directly by the number - or density - of hatchery smolts passing through the system at present population levels. While smolts may be delayed at the dams, the general consensus is that they do not normally compete for space when swimming through the bypass facilities (Enhancement Planning Team 1986). The main factor causing mortality during bypass appears to be confinement and handling in the bypass facilities, not the number of fish being bypassed.

Juvenile salmon and steelhead, of both natural and hatchery origin, rear for varying lengths of time in the Columbia River estuary and pre-estuary before moving out to sea. The intensity and magnitude of competition in the area depends on location and duration of estuarine residence for the various species of fish. Research suggests, for some species, a negative correlation between size of fish and residence time in the estuary (Simenstad et al. 1982).

While competition may occur between natural and hatchery juvenile salmonids in - or immediately above - the Columbia River estuary, few studies have been conducted to evaluate the extent of this potential problem (Dawley et al. 1986). The general conclusion is that competition may occur between natural and hatchery salmonid juveniles in the Columbia River estuary, particularly in years when ocean productivity is low. Competition may affect survival and growth of juveniles and thus affect subsequent abundance of returning adults. However, these are postulated effects that have not been quantified or well documented.

The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions, as the fish should quickly migrate from the release site. Carson spring Chinook are released into the Wind River at the hatchery site and migrate quickly into the main stem Columbia River migration corridor based on juvenile out-migrant trapping and PIT tag monitoring at Bonneville Dam. Carson spring Chinook releases occur "low" in the Columbia Basin system relative to many other upriver programs, reducing opportunity for competitive interactions.

Predation- USFWS (1994) presented information that salmonid predators are generally thought to prey on fish approximately one-third or less their size. Depending on species and population, hatchery smolts are often released at a size that is greater than their naturally produced counterparts. In addition, for species that typically smolt at one year of age or older (e.g. steelhead, spring Chinook salmon), hatchery-origin smolts may displace younger year classes of naturally produced fish from their territorial feeding areas. Both factors could lead to predation by hatchery fish on naturally produced fish, but these effects have not been extensively documented, nor are the effects consistent (Steward and Bjornn 1990). A primary concern is the potential impact of predation by residualized hatchery steelhead on naturally spawning populations.

In general, the extent to which salmon and steelhead smolts of hatchery origin prey on fry from naturally reproducing populations is not known, particularly in the Columbia River basin. The available information, while limited, is consistent with the hypothesis that predation by hatchery-origin fish is, most likely, not a major source of mortality to naturally reproducing populations, at least in freshwater environments of the Columbia River basin (Enhancement Planning Team 1986). However, virtually no information exists regarding the potential for such interactions in the marine environment.

There is little potential for Carson spring Chinook to prey on natural steelhead fry or parr in the Wind River. Based on time of spawning, steelhead fry would be emerging from the gravel after Carson Chinook had exited the river. Primary spawning and early rearing stage (egg to parr) habitats for natural populations of Wind River steelhead are located in the tributaries and upper basin areas above Carson NFH. However, the life history rearing stage for age-1 parr to age-2 smolt does occur primarily in the Wind River below the hatchery. Parr move into the area as steelhead smolts emigrate. Age-1 parr typically range in size from 80-100mm and age-2 smolts from 140-200mm so neither life history stage would be at a size susceptible to Carson spring Chinook predation. Emigrant sampling conducted by WDFW indicates that steelhead smolts/pre-smolts are not drawn out of the Wind River system early by release of Carson spring Chinook (Pied Piper effect) (Dan Rawding, WDFW, pers. comm.). Available data indicate that Carson spring Chinook smolts exit the Wind River very quickly and that potential negative impacts on listed steelhead within the basin are likely to be negligible. Furthermore, the major reduction in the number of Carson smolts released would further reduce any potential impacts relative to past practices.

Carson spring Chinook releases may contribute to indirect predation effects on listed stocks by attracting predators (birds, fish, pinnipeds) and/or by providing a large forage base to sustain predator populations. On the other hand, a large mass of hatchery fish moving through an area may confuse or distract predators or have a "swamping" effect towards predators providing them prey that are more readily accessible than wild stocks thereby providing a beneficial effect to listed species. Releasing large numbers of hatchery fish may lead to a shift in the density or behavior of non-salmonid predators, thus increasing predation on naturally reproducing populations. Conversely, large numbers of hatchery fish may mask or buffer the presence of naturally produced fish, thus providing sufficient distraction to allow natural juveniles to escape (Park 1993). Prey densities at which consumption rates are highest, such as northern pikeminnow in the tailraces of main stem dams (Beamesderfer et al. 1996; Isaak and Bjornn 1996), have the greatest potential for adversely affecting the viability of naturally reproducing populations, similar to the effects of mixed fisheries on hatchery and wild fish. However, hatchery fish may be substantially more susceptible to predation than naturally produced fish, particularly at the juvenile and smolt stages (Piggins and Mills 1985; Olla et al. 1993).

Predation by birds and marine mammals (e.g. seals and sea lions) may also be significant source of mortality to juvenile salmonid fishes, but functional relationships between the abundance of smolts and rates of predation have not been demonstrated. Nevertheless, shorebirds, marine fish, and marine mammals can be significant predators of hatchery fish immediately below dams and in estuaries (Bayer 1986; Ruggerone 1986; Beamish et al. 1992; Park 1993). Unfortunately, the effect of adding large numbers of hatchery smolts on naturally produced fish in the Columbia River estuary and marine environments is unknown, although many of the caveats associated with predation by northern pikeminnow in freshwater are true also for marine predators in saltwater.

Residualism- Carson spring Chinook releases are not known to residualize in the Wind River where they are released. Available emigrant trap and PIT tag monitoring information indicate a rapid exit of Carson spring Chinook from the Wind River.

Migration corridor/ocean- The hatchery production ceiling called for in the Proposed Recovery Plan for Snake River Salmon of approximately 197.4 million fish (1994 release levels) has been incorporated by NMFS into their recent hatchery biological opinions to address potential main stem corridor and ocean effects as well as other potential ecological effects from hatchery fish. Although hatchery releases occur throughout the year, approximately 80 percent occur from April to June (NMFS 1999a) and Columbia River emigration occurs primarily from April through August. Carson's spring Chinook production is typically released in April at the beginning of the normal hatchery and natural stock emigration season. The total number of hatchery fish released in the Columbia River basin has declined by about 26 percent since 1994 (NMFS 1999c) reducing potential ecological interactions throughout the basin.

Ocean rearing conditions are dynamic. Consequently, fish culture programs might cause density-dependent effects during years of low ocean productivity, especially in near shore areas affected by upwelling (Chapman and Witty 1993). To date, research has not demonstrated that hatchery and naturally produced salmonids compete directly in the ocean, or that the survival and return rates of naturally produced and hatchery origin fish are inversely related to the number of hatchery origin smolts entering the ocean (Enhancement Planning Team 1986). If competition occurs, it most likely occurs in near shore areas when (a) upwelling is suppressed due to warm ocean temperatures and/or (b) when the abundance or concentration of smolts entering the ocean is relatively high. However, we are only beginning to understand the food-chain effects of cyclic, warm ocean conditions in the eastern north Pacific Ocean and associated impacts on salmon survival and productivity (Beamish 1995; Mantua et al. 1997). Consequently, the potential for competition effects in the ocean cannot be discounted (Emlen et al. 1990).

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria.

The primary source of fish culture water used at this facility is Tyee Springs located approximately 3/8 mile from the hatchery site. Tyee Springs is an exceptional water source producing 44 second-feet of 44°F, high quality water. A feral brook trout, *Salvelinus fontinalus,* population is established in Tyee Creek, which supplies the spring-water to the hatchery. Bacterial kidney disease is present in the brook trout population at very low levels. Attempts to eradicate the trout have been unsuccessful. Periodic monitoring is conducted to determine the level of infection. The presence of the trout, in the water source, has had no noticeable effect on the hatchery fish in recent years. The other source of fish culture water is the Wind River. This source is used on an as needed basis, primarily in the upper earthen pond, in September after most natural, spawned carcasses have dissipated above the hatchery intake. While the number of spawners is limited, there is evidence from fish health records (Lower Columbia River Fish Health Center, 1970-present) that use of this water may contribute to outbreaks of infectious hematopoeitic necrosis, bacterial kidney disease, and furunculosis in hatchery fish. The Wind River intake does not meet NMFS ESA criteria for anadromous salmonids. This structure is antiquated, unsafe, and needs replacement. Significant funding will be required to bring the Wind River water intake structure into ESA compliance. Wind River water withdrawals should be minimized until the screening problem is corrected. See discussion in Section 2.2.3.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or

effluent discharge.
(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

The primary water source for the Carson NFH is Tyee Creek and is not accessible to anadromous fish. During limited periods of the year, water may be drawn from the Wind River to adjust water temperatures for rearing and to supplement Tyee Creek withdrawals. Intake screening for the Wind River withdrawal pipe does not meet current NOAA Fisheries ESA screening standards. However, with the reduced production program at Carson NFH, water withdrawal from the Wind River for hatchery operations is significantly reduced and short-lived when it does occur late in the summer. Work is underway to bring this water intake structure into NOAA Fisheries ESA compliance. Until the Wind River water intake structure is upgraded, withdrawal of Wind River water for hatchery operations will be minimized. A temporary screen is utilized when withdrawal from the Wind River is necessary. Water withdrawals for hatchery operations are not expected to have a significant negative impact on natural spawning populations. Entry of listed species into the hatchery through the river intake structure has not been observed.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

Returning spring Chinook are collected for brood stock at the hatchery rack. Hatchery fish volitionally return to the hatchery using the hatchery's fish ladder, homing into Tyee Creek. There is no barrier dam in the Wind River at the hatchery. This is significant because the Wind River watershed upstream of the hatchery is an important spawning and rearing area for native summer steelhead trout (listed).

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Not applicable to Carson NFH.

5.2) Broodstock holding and spawning facilities.

The 2 adult holding ponds are 140 feet long, 40 feet wide, and 4 feet deep.

5.3) Incubation facilities.

Eggs are loaded into vertical tray incubators at a rate of 6,000 eggs per tray. Egg size varies from 1,050 to 1,350 eggs per pound. During incubation, the water is 45-47 °F and is saturated with oxygen. Formalin treatments (250mg/L for 15 minutes) are performed three times per week. Flow in the incubators is 3 gpm for eyed eggs and 5 gpm for fry.

5.4) Rearing facilities.

Rearing facilities consist of 46, 8’ wide by 80’ long outside raceways, 2 earthen ponds, and 1 adult pond.

5.5) Acclimation/release facilities.

Final rearing and acclimation occurs in 28 raceways, 2 earthen ponds, and one adult pond.

5.6) Describe operational difficulties or disasters that led to significant fish mortality.

There have not been any operation difficulties or disasters at Carson NFH in the past 6 years.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.
(e.g. “The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.”).

The hatchery ladder was closed to returning adult spring Chinook adults on 1 August 2001 and 2002 as agreed upon by all agencies involved. Prior to 2001, all returning adults were allowed into the hatchery through August or the end of the spawning run. Keeping the ladder open until the end of the run is recommended to minimize ecological interactions and potential disease transmission between hatchery fish and steelhead.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.
List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

See Section 6.2.1

6.2) Supporting information.
6.2.1) History.
Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

Production and Management History—A Washington State operated fish hatchery established at the mouth of the Wind River in 1899 was closed in 1938 when the hatchery grounds and buildings were flooded by the backwaters of Bonneville Dam. The state facility supported a significant fall Chinook salmon run taking a high of 20,357,000 eggs in 1917. The Service operated this facility for a two-year period (1936-37). In 1938, it's final year of operation, 1,907,300 eggs were taken. A Special Use Permit issued by the U.S. Forest Service reserved 10 acres within the Gifford Pinchot National Forest for the purpose of establishing a fish cultural station. Construction of Carson NFH began in June 1937 and production was launched in December of that same year with the arrival of 3,000,000 fall Chinook salmon eggs from the Little White Salmon NFH.

In 1953, protection was provided to the hatchery water supplies when approximately 220 acres were "... withdrawn from all forms of appropriation under the public-land laws, including the mining laws but not the mineral-leasing laws, and reserved for use by the Fish and Wildlife Service of the Department of the Interior as the Carson Fish-Cultural Station" (Federal Register Volume 18, Number 204 Saturday, October 17, 1953). The area withdrawn was described in a letter from the Chief of Forest Service 05/27/53 as ". . . the hatchery site occupying around 20 acres, and the rights-of-way for a 3,385 ft and a 2,700 ft pipeline. The balance of the area lies between the pipelines and around the development." Primary jurisdiction of the withdrawn land, with the exception of the 20 acre developed hatchery site, remained with the Forest Service. The Forest Service, providing additional protection from some U.S.D.A. Forest Service management activities, designated approximately 130 acres surrounding Tyee Springs as Wildlife Special.

Hatchery expansion began in 1952 and was nearly complete by the end of 1955. Prior to expansion, lack of outdoor facilities limited production to indoor rearing troughs. The expansion included the construction of 46 raceways, two adult holding ponds, a service building with space for an office, cold storage and a feed room, 3 duplex housing units, and a paint and oil house.

Fall Chinook salmon were the dominant species reared at Carson NFH from 1937 to 1964. Rainbow trout, black spotted trout (Yellowstone cutthroat), brook trout, steelhead, spring Chinook salmon, coho salmon, sockeye salmon (shipped as eyed eggs), and kokanee were raised intermittently in large numbers from 1938 through 1981 at which time production was switched exclusively to spring Chinook salmon. Nearly all of the fall Chinook were released into Tyee Creek or the main stem Wind River as were most of the trout. Coho were primarily released in the Wind and Columbia Rivers.

Prior to completion of fish passage facilities at Shipherd Falls in 1954, Carson NFH had many false starts with Chinook salmon. Spring Chinook eggs were transferred from the Clackamas River, Oregon Camas Creek, Idaho, and a Willamette River hatchery, Oregon. All attempts to get Chinook salmon back to the hatchery to develop a hatchery brood stock failed until adequate passage was provided past Shipherd Falls.

The fish ladder around Shipherd Falls is located approximately two miles from the mouth of the Wind River and was completed in 1955 as part of the Columbia River Fishery Development Program (Mitchell Act). Coincident to the construction of the fish ladder, was an extensive expansion of the hatchery. The goal of the expansion was to produce spring Chinook, fall Chinook, coho, blue-back (sockeye) salmon, and steelhead to artificially enhance natural production of the Wind River Basin. No more than half the fish of any run were to be artificially spawned with the exception of the blue-back (Lower Columbia Fisheries Development Program, Wind River Area, 1951). Although the expansion was completed, no serious attempts to raise any fish other than spring Chinook materialized. A long-range cooperative federal/state program was implemented to trap upriver spring Chinook adults at Bonneville Dam and transport them to Carson NFH for stock development.

From 1955 thru 1964 approximately 500 spring Chinook salmon were trapped annually at Bonneville Dam on the Washington side of Columbia River and transported to the holding ponds at Carson National Fish Hatchery. Genetic data indicate that the Carson stock was derived from a mixture of upper Columbia and Snake River populations passing Bonneville Dam (Campton 2000 Draft). The adult fish were held and spawned, with their progeny reared and released at Carson. Although small numbers of spring Chinook were counted past the newly constructed Shipherd Falls fishway on Wind River in 1956,1957, and 1958, the first returns to Carson NFH did not occur until 1959 when 107 fish entered the hatchery (99 jacks, 2 adult females and 6 adult males). This run of spring Chinook has been maintained since then and continues to flourish. Annual returns to Carson NFH have averaged 3,797 since 1980 with over 10,000 returning in 1990, 2000 and 2001. Recent production and run data for spring Chinook salmon returning to Carson NFH is summarized and provided in Attachments 13 and 14.

Spring Chinook smolt production was reduced from 2.1 to 1.42 million beginning with brood year 1996. Pond density was reduced to the level suggested as optimum by Banks (1994) to result in a more “fit” smolt, thus increasing post-release survival. In combination with reduced densities, culling of eggs from adult fish with high titer Bacterial Kidney Disease (BKD) has nearly eliminated fingerling and smolt losses to this disease. As a result of these practices, prophylactic erythromycin treatments are no longer necessary during juvenile rearing.

Carson origin spring Chinook eggs, fry, and fingerlings have been transferred to a wide range of localities including Alaska (over 2 million eggs in the early 1970's), Oregon (22.9 million eggs from 1957 to 1993), Idaho (15.9 million eggs from 1960 to 1980), and several hatcheries in Washington (29.7 million eggs from 1957 to1991). The strain has prospered at many locations, for example Leavenworth and Little White Salmon NFHs, Washington and Umatilla River, Oregon.

From 1960 to 1997, juvenile hatchery steelhead (Skamania stock) were outplanted in the Wind River from a State of Washington hatchery. Hatchery outplanting of Skamania stock summer steelhead was terminated by WDFW in 1997 because of possible genetic and ecological impacts from hatchery steelhead on wild steelhead.

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their *population status relative to critical and viable thresholds.*

Not applicable to Carson NFH.

6.2.3) Past and proposed level of natural fish in broodstock.
If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

Not applicable to Carson NFH.

6.2.4) Genetic or ecological differences.
Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

Genetic or ecological difference between hatchery and "natural" stocks is unknown. However, it is likely that little genetic or ecological differences exist between the fish returning to Carson NFH and those fish spawning naturally in Wind River, as these fish are believed to be Carson hatchery fish that did not return to the hatchery rack.

6.2.5) Reasons for choosing

See Section 6.2.1

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Not applicable to Carson NFH.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adult spawners returning to Carson NFH volitionally enter the holding ponds and are held until ripe.

7.2) Collection or sampling design.
Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

Adult spring Chinook enter the hatchery holding pond from May to August. Spawning occurs in August and early September. Fish are collected from throughout the spectrum of the run.

7.3) Identity

Voluntary hatchery returns are used in the spawning process. If any “natural” spring Chinook voluntarily enter the hatchery, they are incorporated into the brood stock. However, because spring Chinook are not native to the Wind River, these fish also would be of Carson stock origin.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

Current program needs for Carson NFH is 500 females and 500 males at time of spawning. The 1,400 adult escapement goal is to allow for the expected male to female ratio of 45% to 55%, respectively, to maintain the 1:1 spawning criteria, and to allow for the culling of eggs from high titer BKD infected fish. The escapement goal includes any pre-spawning mortalities that may occur during the extended holding period of adults at the hatchery.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2. Numbers of fish spawned at Carson NFH, 1980-2001 (Carson CHMP, CRiS database).

Year	Female	Male	Jacks	Total
1980	1,920	1,448	32	3,400
1981	1,425	1,123	3	2,551
1982	1,027	629	20	1,676
1983	1,515	959	4	2,478
1984	1,068	719	45	1,832
1985	2,324	1,433	62	3,819
1986	1,687	1,056	67	2,810
1987	1,714	1,247	4	2,965
1988	1,161	727	56	1,944
1989	1,098	861	162	2,121
1990	1,059	794	34	1,887
1991	1,661	1,144	40	2,845
1992	1,362	1,043	17	2,422
1993	1,657	1,125	2	2,784
1994	474	365	0	839
1995	233	225	81	539
1996	933	691	22	1,646
1997	630	501	3	1,134
1998	503	391	12	906
1999	511	426	85	1,022
2000	525	505	162	1,192
2001	525	381	205	1,111
Mean	1,137	809	51	1,997

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Table 7.5 depicts disposition of hatchery fish from 1987-2000, followed by a description of the term “use” (CRiS database).

Year	Male	Female	Jack	Use
1987	122	733	1	2
	208	317	3	5
		10		6
		22		7
		1		9
1988	13	16	56	2
	34	84		5
		7		6
		12		7
1989	13	11	157	2
	51	92		5
		3		6
		5		7
1990	169	541	34	2
	56	71		5
		21		7
		1		8
1991	4	3		0
	23	39	40	2
	142	231		5
		8		7
1992	18	51	17	2
	142	205		5
		11		6
		3		7
	3	3		8

Year	Male	Female	Jack	Use
1993	9	11		0
	12	27		2
	71	137	2	5
		23		7
	3			8
1994	30	43		5
		1		6
		6		7
	2			8
1995	14		69	2
	6	5	2	5
		1		7
1996	96	631	17	2
	6	31	2	5
		5		7
1997			1	2
	2	6		5
	8	12	1	6
1998	15	14	1	5
	3		1	6
1999	15	392	65	2
	11	5		5
	6	4	2	6
2000	88	515	147	2
	13	19		5
		1		7

Use Number	Description
0	Unknown
1	Spawned
2	Surplus
3	Passed Upstream
4	Transferred
5	Dead in Pond
6	Bad Fish
7	Green Female
8	Jumped Out
9	Poached

7.6) Fish transportation and holding methods.

Describe procedures for the transportation (if necessary) and holding of fish, especially if *captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics*.

No transportation necessary. Adult fish volitionally swim into hatchery.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish Health Policy—The Lower Columbia River Fish Health Center (FHC) in Underwood, WA provides fish health care for Carson NFH under the auspices of the published policy 713 FW in the Fish and Wildlife Service Manual (FWM). In addition to this policy, the 1994 annual report "Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries", by the Integrated Hatchery Operations Team (IHOT 1995) provide further fish health guidelines as approved by northwestern state, federal, and tribal entities. The directives of these two documents meet the requirements of Washington's state and tribal fish health entities and are consistent with the directives in the Co-Managers' Salmonid Disease Control Policy of 1998.

The documents mentioned above provide guidance for preventing or minimizing diseases within and outside of the hatchery. In general, movements of live fish into or out of the hatchery must be approved in the U.S. v Oregon Production Advisory Committee forum (Objective 6) and be noted on the State of Washington Brood Document for the hatchery. If a fish transfer or release is not on the Brood Document, permits from the Washington Department of Fish and Wildlife, the Service, and any other states through which the fish travel must be obtained and approved by co-managers. Fish health exam and certification must be done prior to any releases or transfers from the hatchery to minimize risks from possible disease transmittance.

Fish Health Examinations—Monthly examination: A pathologist from the FHC visits once per month to examine fish at the hatchery. From each stock and broodyear of juveniles, fish are randomly sampled to ascertain general health. Based on pathological signs, age of fish, concerns of hatchery personnel, and the history of the facility, the examining pathologist determines the appropriate tests. This usually includes a necropsy with an external and internal exam of skin, gills, and internal organs. Kidneys (and other tissues, if necessary) will be checked for the common bacterial pathogens by culture and by a specific test for bacterial kidney disease (BKD). Blood is checked for signs of anemia or other infections, including viral anemia. Additional tests for virus or parasites are done if warranted. The pathologist will also examine fish that are moribund or freshly dead to ascertain potential disease problems in the stocks.

Diagnostic Examination: This is done on an as-needed basis as determined by the pathologist or requested by hatchery personnel. Moribund, freshly dead, or fish with unusual signs or behavior are examined for disease using necropsy and appropriate diagnostic tests. A pathologist will normally check symptomatic fish during a monthly examination.

Ponding Examination: The first health exam of newly hatched fish occurs when approximately 50% of the animals are beyond the yolk sac stage and begin feeding.

Sixty fish will be sampled and tested for virus.

Pre-release Examination: At two to four weeks prior to a release or transfer from the hatchery, 60 fish from the stock of concern are necropsied and tissues taken for testing of listed pathogens. The listed pathogens, defined in Service policy 713 FW (Fish and Wildlife Service Manual) include infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum, Aeromonas salmonicida, Yersinia ruckeri*, and *Myxobolus cerebralis*.

Adult Certification Examination: At spawning, tissues from adult fish are collected to ascertain viral, bacterial, and parasite infections and to provide a brood health profile for the progeny. The FHC tests for all of the listed pathogens, except *Myxobolus cerebralis*, and including *Ceratomyxa shasta*. The minimum number of samples collected is defined by 713 FW. At Carson NFH, all brood females are tested for *R. salmoninarum* (causative agent of BKD), with an identifying fish health number corresponding to each female's eggs so that selective culling and/or segregation is possible. This is done to reduce/control BKD, a vertically transmitted disease. Progeny from females with high levels of BKD are culled (if not needed to make production goals) or segregated from progeny at lower risk. The FHC provides results from testing within four weeks to allow management decisions.

Chemotherapeutant Use—Erythromycin injections for brood stock are critical to the control of bacterial kidney disease that is caused by a vertically transmitted bacterium (*Renibacterium salmoninarum*) that can reside in the ovarian and seminal fluids. In addition, erythromycin injections control the mortality and reduce horizontal transmission of BKD between adults in the brood pond. The injection schedule is set to maximize the number of adults injected, with a goal of two injections for the early arriving adults and one injection for the later arrivals. To reduce bacterial numbers in the reproductive fluids and to deposit the drug inside the ova, erythromycin must be injected at a dosage of 20 mg drug/kg of fish at 30 days prior to spawning. At Carson NFH, the first injection is scheduled on about June 12th and the second injection on about July 12th. Except for fish arriving too close to the time of spawning for safe handling and injection, all spring Chinook salmon adults kept for broodstock are injected. The injected drug is Erythro-200 or Erythro-100 (200 mg/ml or 100 mg/ml, respectively, of active erythromycin base in PEG, ethly actate and ethyl alcohol), to be injected in the dorsal sinus at 20 mg drug/kg of body weight.

Since 1998 (brood year 97 juveniles), prophylactic medicated feedings to control BKD in juveniles has been deemed unnecessary. The reduced levels of BKD in the juveniles is attributed to lowered densities ($\leq$ 0.25 density index and < 1.0 flow index) during rearing, regular cleaning and maintenance of individual equipment (nets, etc.) for each pond, erythromycin injection of the adults, culling/segregation of progeny from highly infected females, and the use of Tyee Springs water for rearing. Should prophylactic feeding be necessary, as determined by the FHC, juveniles are to be fed at a daily dosage of 100 mg/kg of fish for a minimum of 21 days unless contraindicated by drug toxicity or needed feeding rate adjustments. The time and number of treatments will be dictated by circumstances. As of 2001, there is a temporary INAD 4333 that allows feeding of Aquamycin 100 (erythromycin thiocyanate in a wheat flour base) and prescription by a veterinarian is not required.

Formalin treatment of adults held for brood stock is used to control external pathogens three times per week prior to spawning.

Salmonid egg hardening and disinfection treatment with a polyvinylpyrrolidone iodine compound (approximately 1% iodine) is required by 713 FW policy to minimize/prevent transmittance of viral and bacterial pathogens. The eggs shall be disinfected in 50 ppm iodine in water buffered by sodium bicarbonate (at 0.01%) for 30 minutes during the water-hardening process. Eggs received at the hatchery must be disinfected before they are allowed to come in contact with the station’s water, rearing units or equipment.

Other Fish Health Precautions—Unless research regarding vertical transmittance of BKD proves otherwise, eggs from female brood stock with high levels of BKD (a cut-off point selected by the NFH and FHC managers based on results from the Enzyme-Linked Immunosorbent Assay or ELISA) will not be used in production unless egg production is low. If the number of brood females is low, progeny from highly infected females shall be segregated into rearing units apart from the rest of the production and absolute fastidiousness maintained as to using equipment that is disinfected and/or dedicated to these rearing units.

Where feasible, a yearly draw down, pressure wash, and drying of the dirt ponds is recommended to reduce problems induced by fungus, bacteria and parasites. If necessary, a formalin treatment may be applied to the surface.

Returning spring Chinook salmon that are allowed to remain in the Wind River upstream of the hatchery can serve as a reservoir of pathogens for the fish in the hatchery. Because of this, the standard practice is to rear juveniles on Tyee Creek water. Returning spring Chinook salmon have a relatively high incidence of infectious hematopoietic necrosis virus (IHNV), ranging from 41 to 88% and in 1988 to 1995 when water from the river was used for rearing, the juveniles in the hatchery experienced small to large epizootics of IHNV. In addition, the juveniles also succumbed to furunculosis, which is found in about 1/3 of dying spring Chinook salmon adults. The risk from bacterial kidney disease in the juveniles is also enhanced, with evidence from this and other hatcheries that horizontal transmission occurs when infected adults are in the water supply. Since 1996, Wind River water has not been by the hatchery used for rearing. Coincidentally, there have been no isolations of IHNV, no detection of furunculosis, and a reduced incidence of BKD in the juveniles. A precautionary consideration might be to remove all spring Chinook salmon adults from the Wind River prior to spawning to reduce the potential of infecting native steelhead that could also serve as a reservoir of infection.

Drugs and chemicals for treating fish are used on an “as needed” basis. Formalin treatments for adult brood stock are given to control external parasites and as a fungicide on eggs. Studies are currently (2001) underway to determine if egg antifungal treatments are truly necessary. It is becoming increasingly difficult to comply with OSHA, safety and fire codes and regulations. Minimizing chemical and drug use will not only reduce impacts on the local environment but will make compliance with the various safety regulatory agencies much easier, as well as reduce risks to employees. Towards that end, an electro-anesthesia system should be in place by the BY 2002 spawning season. Use of this device will virtually eliminate the need for the anaesthetic MS-222.

Tank trucks and tagging trailers are disinfected before being brought onto the station and after use at the hatchery.

Abernathy Fish Technology Center provides quarterly feed quality analysis to prevent disease and meet nutritional requirements of fish.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor as per the USFWS Fish Health Policy.

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are kept in separate ponds or incubation units. Water is not reused.

- Tank trucks or tagging trailers are disinfected when brought onto the station. Footbaths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

All of the above practices would minimize potential negative effects on natural populations of fish by lessening the chance for horizontally transmitted diseases.

7.8) Disposition of carcasses.
Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

See Section 7.7

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.
(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

See section 3.5 for discussion on ecological interactions.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.
Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

As mentioned in section 7.2, brood stock are collected that represent the entire spectrum of the run. Fish are sorted and ripe females spawned until 100% of the fish have been checked. Green females are passed back to the holding ponds with an adequate number of males to assure a 1:1 mating ratio. The eggs collected during a given sort are considered an egg "take". Male spawners are randomly selected during the sort. Jack males are used in proportions representative of their return rate. In years of high jack returns, a larger proportion of jacks are used as spawners, up to a five percent maximum. The number of jacks to be spawned on a given day is subjectively defined by hatchery staff and is determined by jack availability and ripeness. After all of the adult fish being held have been sorted and ripe females spawned, a maximum one-week period is allowed to pass before the fish are re-sorted and newly ripened females spawned. The objective is to achieve maximum fertilization by spawning fish soon after ovulation and yet avoid the needless handling of green females. The re-sorting process continues until all fish are spawned.

8.2) Males.

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

If the hatchery escapement goal is met, then a 1:1 spawning ratio will be achieved. This is one of the highest brood stock program goals at the hatchery. During low escapement years, males are re-used on an as-needed basis to achieve production goals. This practice was thoroughly discussed with the U.S. Fish & Wildlife Service hatchery geneticist to assure that the uncommon practice of reusing male fish did not compromise the genetic diversity of the hatchery stocks. It was determined that, in all instances, a minimum escapement need had been met to maintain genetic diversity, although some male fish had to be reused to achieve production goals.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

It is important to note that at no time in the recent past has the hatchery pooled the eggs of females prior to fertilization. Again, as mentioned in section 8.1 above, an intense effort is made to achieve a 1:1 spawning ratio. The following is a detailed description of the spawning protocol.

Adults are crowded from holding ponds and anesthetized using tricane methane sulfonate (MS-222). Anesthetized adults are then sexed and checked for ripeness. Ripe adults are killed with a blow to the head. Tails of all females spawned are cut to allow bleeding for approximately 3-5 minutes. Eggs are then removed using a Wyoming knife and collected in iodophor-disinfected stainless steel colanders to drain ovarian fluid. The eggs are then transferred to iodophor-disinfected plastic buckets and sperm is added directly to the eggs. A 1:1 random spawning ratio is maintained and male jacks are used proportionally to their percentage of the run. The fertilized eggs are stirred and allowed to rest for a minimum of thirty seconds, then washed and water hardened for one half hour in a 75 mg/L iodophor solution. The eggs are then transferred to plastic colanders placed in a trough filled with water, inside the hatchery. The eggs are incubated using single pass spring water, until the eggs eye-up. Once the eggs are eyed-up they are transferred to and held in individual Heath incubator trays until hatching occurs. Aseptic procedures are followed to assure equipment is disinfected throughout the egg handling process.

All spawned adult spring Chinook are assigned an individual identification number to assist in sampling and identification of egg lots. Enzyme linked immunosorbent assay (ELISA) sampling is performed on all spawned adults to assist with the culling or segregation of progeny having a high likelihood of contracting bacterial kidney disease. All eggs from females with medium high or high titer of *Renibacterium salmoninarum* (causative agent of bacterial kidney disease) are culled. Additional fish health samples are collected to determine the incidence of other pathogens.

See also 7.4.2 for numbers of fish spawned from 1980-2001.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability.

Cryopreservation of gametes is not performed at Carson NFH.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program"*.).

Not applicable to Carson NFH.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Provide data for the most recent twelve years (1988-99), or for years dependable data are available.

Data for table 9.1.1 provided by CRiS database.

Brood Year	Eggs Taken	Eye-up (% survival egg to eye-up)	Ponded (% survival egg to ponding)	* Release (% survival pond to release)
1990	4,184,600	87%	82%	89%
1991	7,279,350	91%	84%	83%
1992	5,758,800	97%	94%	77%
1993	7,637,990	94%	89%	80%
1994**	2,021,225	92%	92%	93%
1995	1,074,835	96%	96%	88%
1996	3,998,050	96%	92%	79%
1997	2,924,828	95%	89%	100%
1998	2,302,287	93%	92%	75%
1999	2,194,698	91%	89%	94%
2000	2,216,032	87%	86%	96%
2001	2,224,100	90%	87%	
Mean	3,651,400	92%	89%	87%

* Number is an actual count, other numbers are estimated.
** Includes 320,000 fingerlings released from 1993 brood year.

9.1.2) Cause for, and disposition of surplus egg takes.
Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent accedence of programmed levels.

Not applicable to Carson NFH.

9.1.3) Loading densities applied during incubation.
Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

Eggs are loaded into vertical tray incubators at a rate of 6,000 eggs per tray. Egg size varies from 1,050 to 1,350 eggs per pound. Flow in the incubators is 3 gpm for eyed eggs and 5 gpm for fry.

9.1.4) Incubation conditions.
Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

During incubation, the water is 45-47 °F and is saturated with oxygen. Formalin treatments (250mg/L for 15 minutes) are performed three times per week.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight

(and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Fry are ponded into 18, 8' wide by 180' long outside raceways before button-up or approximately 1650 temperature units (TUs).

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

A sample of 60 fish from each lot is tested for viruses.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

The hatchery backup system includes a phone dial-out notification of employees if a water alarm occurs. All raceways, ponds, and incubators are connected to the alarm system. A water bypass system is in place to deal with any flooding that may occur in Tyee Creek. Back-up generators are used to power the trash removal system.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Refer to Table 9.1.1

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

A maximum density index is 0.25. Fish growth is sampled monthly and extrapolated to the following month to ensure this level is not exceeded.

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

Fry are placed in raceways divided in half until the density index gets close to 0.25 when the center screens are removed to lower densities. Feeding frequency ranges from 1 to 8 per day and percent body weight fed ranges from 0.6-2-%depending upon fish size and time of year. Flow is 380 gpm and oxygen levels are at saturation level during inflow and outflow is never lower than 6 ppm. The lower earthen pond is the only rearing unit that gets second pass water from the upper earthen pond. When both ponds are in use, minimum flow is 4,000 gpm but typically 4,500-5,000 gpm is maintained.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4. Fish growth data from Carson NFH.

Date (month-year)	Length (inches)	Number per Pound	Condition Factor (C)	Monthly Conversion	Density Index	Flow Index
January-00	1.475	1038	0.0003	0.70	0.08	0.29
February-00	1.867	512	0.0003	0.86	0.13	0.46
March-00	2.343	259	0.0003	0.64	0.20	0.48
April-00	2.834	146	0.0003	0.58	0.15	0.60
May-00	3.190	103	0.0003	1.20	0.06	0.29
June-00	3.528	76	0.0003	1.39	0.07	0.35
July-00	3.877	57	0.0003	0.86	0.09	0.42
August-00	4.483	37	0.0003	0.68	0.12	0.65
September-00	4.717	32	0.0003	1.45	0.13	0.69
October-00	4.862	29	0.0003	1.66	0.14	0.74
November-00	4.951	27	0.0003	1.56	0.08	0.50
December-00	5.042	26	0.0003	1.47	0.08	0.54
January-01	5.227	23	0.0003	1.30	0.09	0.58
February-01	5.471	20	0.0003	0.93	0.09	0.64
March-01	5.766	17	0.0003	0.97	0.11	0.71
April-01	5.976	16	0.0003	0.78	0.11	0.76

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Table 9.2.4.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Table 9.2.6. Lot history production for Brood Year 2000.

	Fish Food	Conversion			Temperature Units

Date	Pounds per Month	Cumulative	Cost	Month	Cumulative	Cost per Pound Gain	Current Length Increase	Monthly	Cumulative	TUs per Inch Gain	TUs per Inch Month
Jan-01	264	264	267	0.70	0.70	0.71	0.141	5.6	5.6	39.7	39.7
Feb-01	1,276	1,540	1,394	0.86	0.82	0.75	0.392	11.9	17.5	32.8	30.3
Mar-01	1,825	3,365	3,068	0.64	0.71	0.65	0.476	12.0	29.5	29.2	25.2
Apr-01	2,585	5,950	5,180	0.58	0.65	0.56	0.491	12.5	42.0	28.0	25.4
May-01	4,635	10,585	8,090	1.20	0.81	0.62	0.357	11.6	53.6	28.8	32.5
Jun-01	6,915	17,500	11,942	1.39	0.97	0.66	0.338	11.7	65.3	29.7	34.6
Jul-01	5,400	22,900	14,426	0.86	0.94	0.59	0.349	13.2	78.5	30.8	37.7
Aug-01	9,389	32,289	18,341	0.68	0.85	0.48	0.605	12.5	91.0	28.9	20.6
Sep-01	9,336	41,625	22,187	1.45	0.93	0.50	0.234	14.0	105.0	31.0	59.9
Oct-01	7,208	48,833	25,343	1.66	1.00	0.52	0.146	13.5	118.5	33.5	92.7
Nov-01	4,356	53,189	27,042	1.56	1.03	0.52	0.089	13.3	131.8	36.4	149.0
Dec-01	4,312	57,501	28,834	1.47	1.05	0.53	0.090	13.0	144.8	39.0	143.8
Jan-02	8,295	65,796	32,363	1.30	1.08	0.53	0.185	12.7	157.5	40.4	68.5
Feb-02	8,425	74,221	35,795	0.93	1.06	0.51	0.244	11.3	168.8	40.8	46.4
Mar-02	11,772	85,993	40,766	0.97	1.05	0.50	0.295	11.3	180.1	40.6	38.2
Apr-02	7,360	93,353	43,806	0.78	1.02	0.48	0.210	11.4	191.5	41.2	54.3

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Refer to section 7.7

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not available at this time for Carson NFH.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Natural rearing includes the two earthen ponds with natural rock substrate and aquatic vegetation for cover. The raceways have a polyurethane coating that is pigmented to match the natural colors of Wind River substrate.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation. (*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size."*)

Fish are reared to smolt-size and released to minimize the time spent in the migratory corridor. This minimizes potential interaction with any listed fish in the Wind and Columbia rivers.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.
Specify any management goals (e.g. number, size or age at release, population uniformity,

residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in* ***Attachment 2****. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	1.42 million	18	3rd week of April	Wind River

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: *(include name and watershed code (e.g. WRIA) number)*
Release point: Fish are released on station.
Major watershed: Wind River
Basin or Region: Columbia River

10.3) Actual numbers and sizes of fish released by age class through the program.
For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in ***Attachment 2****. Cite the data source for this information.*

Fish release data compiled from CRiS database.

Release Year	Fry (millions)	Average Size*	Fingerling (millions)	Average Size*	Fall Yearling	Average Size*	Yearling (millions)	Average Size*
1980							2.59	23.48
1981							2.60	19.81
1982							2.58	18.47
1983							1.72	20.00
1984							2.89	16.55
1985							2.39	20.40
1986			0.14	102.00	0.19	35.00	2.39	19.88
1987							2.34	18.78
1988	0.21	1,282	0.41	69.51			1.96	19.00
1989	0.31	1,258					1.98	18.00
1990							2.11	19.00
1991							2.34	18.00
1992							2.32	18.00
1993							2.32	20.00
1994			0.32	98.00			2.04	19.00
1995							2.20	18.06
1996							1.72	19.72
1997							0.91	16.00
1998							1.73	17.00
1999							1.42	13.00
2000							1.43	16.00
2001							1.61	15.00
2002							1.45	16.00
Mean	0.26	1,270	0.29	89.84	0.19	35.00	1.95	18.22

* Average size is reported in number per pound.

10.4) Actual dates of release and description of release protocols.

Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

Table 10.4. Release dates, stage, number of fish, and number per pound of Carson National Fish Hatchery spring Chinook salmon, 1980-2002 (CRiS Database).

Date	Stage	Number	Number per Pound
04/02/80	yearling	245,854	29.17
04/28/80	yearling	2,295,207	22.78
05/12/80	yearling	44,550	24.15
03/24/81	yearling	442,835	25.4
04/15/81	yearling	2,156,077	19.4
04/07/82	yearling	656,976	20.2
04/15/82	yearling	1,921,674	18.1
04/15/83	yearling	1,722,080	19.6
04/12/84	yearling	2,017,670	15.6
04/13/84	yearling	868,890	17.99
02/13/85	yearling	664,740	27.2
02/15/85	yearling	182,300	26.5
04/11/85	yearling	18,494	17.19
04/15/85	yearling	1,525,437	18.31
03/06/86	yearling	443,000	25.3
04/15/86	yearling	1,949,468	19.26
06/23/86	fingerling	140,000	102
11/26/86	fall	185,000	34.7
04/10/87	yearling	47,496	19
04/15/87	yearling	1,808,694	18.77
04/16/87	yearling	482,974	18.3
01/21/88	fry	206,610	1281.8
04/14/88	yearling	833,420	19.1
04/15/88	yearling	1,122,800	19.15

Date	Stage	Number	Number per Pound
07/12/88	fingerling	237,995	65.9
07/13/88	fingerling	173,197	74.9
01/13/89	fry	307,000	1258
04/19/89	yearling	437,998	18.3
04/20/89	yearling	1,445,641	17.92
04/27/89	yearling	100,000	18.1
04/12/90	yearling	1,052,641	18.8
04/13/90	yearling	1,052,640	18.8
04/15/92	yearling	4,652,170	18.29
04/14/94	yearling	4,361,853	19.22
04/10/95	yearling	127,113	18.7
04/13/95	yearling	666,073	18.42
04/14/95	yearling	1,402,006	18.07
02/08/96	yearling	600,000	24
04/08/96	yearling	44,034	18.46
04/18/96	yearling	1,046,363	17.75
04/19/96	yearling	32,224	18.36
04/17/97	yearling	907,708	15.53
04/20/98	yearling	1,734,188	16.57
04/20/99	yearling	1,415,744	12.55
04/20/00	yearling	1,430,022	15.57
04/19/01	yearling	1,608,684	14.95
04/17/02	yearling	1,449,361	15.62

10.5) Fish transportation procedures, if applicable.
Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

Not applicable to Carson NFH.

10.6) Acclimation procedures (*methods applied and length of time*).

All fish are reared and released on-station.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All fish are adipose clipped prior to release to identify them as hatchery fish upon return. Annually, 75,000 fish are coded-wire tagged as an index group, and is part of the ongoing stock assessment evaluation of Carson NFH. A portion of the release is PIT tagged as part of a comparative survival study to address main stem Columbia River passage issues.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

See Table 7.5 for number and disposition of fish not spawned.

10.9) Fish health certification procedures applied pre-release.

Pre-release Examination: At two to four weeks prior to a release or transfer from the hatchery, 60 fish from the stock of concern are necropsied and tissues taken for testing of listed pathogens. The listed pathogens, defined in Service policy 713 FW (Fish and Wildlife Service Manual) include infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum, Aeromonas salmonicida*, *Yersinia ruckeri*, and *Myxobolus cerebralis*.

10.10) Emergency release procedures in response to flooding or water system failure.

Fish will be released directly into the Wind River.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.
(*e.g. "All yearling coho salmon will be released in early June in the lower main stem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural Chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

Fish are reared to smolt-size and released to minimize the time spent in the migratory corridor. This minimizes potential interaction with any listed fish in the Wind and Columbia rivers. See section 3.5 for ecological interaction discussion.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

SEE SECTION 1.10 FOR MONITORING AND EVALUATION OF PERFORMANCE INDICATORS.

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

USFWS will continue to seek funding for monitoring and evaluation of performance indicators.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring Chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

Potential take associated with monitoring and evaluation activities is discussed in Section 2.2.3. All monitoring and evaluation activities will attempt to minimize adverse effects to listed species.

SECTION 12. RESEARCH

*Provide the following information for any research programs conducted in **direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish**. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in **Table 1**.*

12.1) Objective or purpose.

There is currently no research beyond normal monitoring and evaluation of the stock using coded wire tags. Research projects in the coming years may include evaluation of NATURES rearing raceways. This study should have no adverse effect on listed species. Also, little data describing the ecological interaction of hatchery Chinook smolts with Endangered Species Act listed Wind River summer steelhead are available. Funding will be pursued to fill this data gap via the fiscal year 2002 FONS submissions. This will be a shared project with the Columbia River Fisheries Program Office.

12.2) Cooperating and funding agencies.

This program currently has no funding allocated for research.

12.3) Principle investigator or project supervisor and staff.

N/A

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Not listed.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

N/A

12.6) Dates or time period in which research activity occurs.

N/A

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

N/A

12.8) Expected type and effects of take and potential for injury or mortality.

N/A

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

N/A

12.10) Alternative methods to achieve project objectives.

No alternatives are proposed at this time.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

N/A

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

N/A

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, *benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.*

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Summer Steelhead ESU/Population: LCR Steelhead/Wind River Activity: Broodstock Collection				
Location of hatchery activity: Carson NFH ladder Dates of activity: May-September Hatchery program operator: USFWS				
Type of Take	**Annual Take of Listed Fish By Life Stage (*<u>Number of Fish</u>*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			5	
Capture, handle, tag/mark/tissue sample, and released)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)			<1	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

<u>Instructions</u>:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).

SECTION 15. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. (Anadromous salmonid effects are addressed in Section 2)

*This section will be the cornerstone for any required consultation with the U.S. Fish and Wildlife Service under section 7 of the ESA. Accordingly hatcheries that may affect any federally listed/ proposed **aquatic or terrestrial** species under USFWS jurisdiction need to complete this section. By fully addressing the topics of this section, the HGMP will provide the information necessary to initiate formal or informal consultation under the ESA for species under USFWS jurisdiction.*

15.1) List all ESA permits or authorizations for USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species associated with the hatchery program.

--NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin 1999
--Internal review of bull trout and hatchery operations below McNary Dam, February 1988.

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, CRITICAL HABITAT, CANDIDATE SPECIES, AND SPECIES OF CONCERN THAT MAY OCCUR IN THE VICINITY OF THE CARSON NATIONAL FISH HATCHERY IN SKAMANIA COUNTY, WASHINGTON

(T5N R7E S32)

FWS REF: 1-3-02-SP-1530

LISTED

Wintering bald eagles (*Haliaeetus leucocephalus*) may occur in the vicinity of the project. Wintering activities occur from October 31 through March 31.

Bull trout (*Salvelinus confluentus*) may occur in the vicinity of the project. The status of bull trout in the Wind River is unknown, but they have been observed below Shipherd Falls and are believed to be part of an adfluvial population that uses Bonneville pool (Wind River Subbasin Summary, WDFW).

Northern spotted owl (*Strix occidentalis caurina*) occur in the vicinity of the project. Nesting activities occur from March 1 through September 30.

PROPOSED

None

CANDIDATE

None

CRITICAL HABITAT

Critical habitat for the northern spotted owl has been designated in the vicinity of the project.

SPECIES OF CONCERN

The following species of concern have been documented in the county where the project is located. These species or their habitat could be located on or near the project site. Species in **bold** were specific occurrences located on the database within a 1 mile radius of the project site. Available information from the Wind River subbasin summary prepared by WDFW follows the list.

Band-tailed pigeon (*Columba faciata*)
Black-tailed deer (*Odocoileus hemiomus*)
California wolverine (*Gulo gulo luteus*)
Cascades frog (*Rana cascadae*)
Larch Mountain salamander (*Plethodon larselli*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Northwestern pond turtle (*Clemmys marmorata marmorata*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific fisher (*Martes pennanti*)
Pacific Townsend’s big-eared bat (*Corynorhinus townsendii townsendii*)
Pacific lamprey (*Lampetra tridentata*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Tailed frog (*Ascaphus truei*)
Western pond turtle (*Clemmys marmorata*)
Western toad (*Bufo boreas*)
Penstemon barrettiae (Barrett's beardtongue)
Rorippa columbiae (Columbia yellow-cress)
Sisyrinchium sarmentosum (pale blue-eyed grass)

Black-tailed Deer—The Wind River is considered important habitat with the lower drainage wintering area for the deer.

Pacific Fisher—The Wind River Subbasin is part of the historical range of the pacific fisher. However, no known population of fisher exists in Washington.

Larch Mountain Salamander—The larch mountain salamander has a restricted range that includes the Wind River subbasin.

15.3) <u>Analyze effects.</u>

Identify potential direct, indirect, and cumulative effects of hatchery program on species and habitat (immediate and future effects, including duration and area of effects). Please focus analysis on the impact of hatchery program on listed/proposed species reproduction, numbers, and distribution.
Identify potential level of take (past and projected future).

The status of bull trout in the Wind River is unknown, but they have been observed below Shipherd Falls and are believed to be part of an adfluvial population that uses Bonneville pool (Wind River Subbasin Summary, WDFW). No reproducing, resident population of bull trout is known to exist in the Wind River (WDFW, 1997). Hatchery juveniles may be providing a forage base benefit to adfluvial bull trout.

There is no anticipated take of listed species as associated with operation of the hatchery.

15.4 <u>Actions taken to minimize potential effects.</u>

Identify actions taken to minimize potential effects to listed species and their habitat.

The conclusion at this time is that hatchery operations will not adversely affect bull trout or any other listed species.

15.5 <u>References</u>

SEE SECTION 13 FOR REFERENCES AND CITATIONS